

## Seat/steering column memory (SM/LSM)

The seat/steering column memory control unit (SM/LSM) is provided for manual as well as automatic positioning of the driver's or passenger's seat and the steering column

The following seat drives can be operated:

- Seat longitudinal adjustment
- Seat height adjustment
- Seat inclination adjustment
- Back-rest inclination adjustment
- Seat depth adjustment (thigh support)
- Head restraint adjustment
- Back-rest adjustment

Following drives can be operated to adjust the steering column:

- Longitudinal adjustment
- Inclination adjustment

A separate adjustment switch is available for each of these drives. The adjustment switches are, in part, combined in switch blocks.

3 memory locations which can be freely programmed by the user are also available for each drive. These memories can be called up by the user at any time.

The actuator motors are activated by means of a control module mounted on the relevant motor. The control module undertakes following tasks:

- Drive of actuator motors with semiconductor switches.
- Position recording of drive without feedback potentiometer, with new "ripple-counter" system.
- The data exchange with the control unit SM/LSM takes place via a data link

In order to effectively reduce the necessary number of wire cores, the complete electronic control circuitry for all seat and steering column drives together with the seat adjustment switch are integrated in one casing.

### Note

The SM/LSM control unit is connected to the peripheral bus (P-bus). For this reason, not only the diagnosis line is involved in the diagnosis link between the service tester and the control unit SL/LSM, but also the body bus (K-bus) and the P-bus. In the case of malfunctions in the diagnostic procedures, the diagnosis link between the diagnosis socket and the instrument cluster electronics (IKE) must be checked. In addition, the K-bus line (between IKE and general module) and the P-bus line (between general module and SM/LSM) must also be checked.

## Memory concept

On the E38, the positions for seat adjustments, steering column adjustment and mirror adjustment can be stored with the memory system.

Following control units are necessary to store all positions:

- All seat and steering column positions are stored in the seat/steering column memory control unit (SM/LSM) in the seat adjustment switch.
- The mirror positions are stored in the peripheral module driver's and passenger's door (PMFT or PMBFT).
- The basic prerequisite for operation of the memory system is that the peripheral module in the driver's door (PMFT) is installed. The programming and selector switch is connected to this module. The PMFT evaluates the status of the switch and transfers the defined status to the P-bus.
- The general module is used in the memory system as a central memory for diagnosis data and as a connection point to the diagnosis computer.
- The control units are mounted in the vehicle relevant to their function and are interlinked via the P-bus link.
- In the E-38 memory system, the information concerning the status of the memory switch is transferred via the P-bus. Each control unit individually evaluates the P-bus data concerning the status of the memory switch and carries out the necessary adjustments independently.

## Consumer load cutout

When the vehicle is switched off, the map reading lights, the glovebox lights, the engine compartment lights and the luggage compartment lights can be switched on. The voltage (B+ supply) for these consumer loads is supplied by the general module.

To ensure the vehicle battery cannot discharge when the lights are permanently switched on, the general module switches off the B+ supply 16 minutes after terminal R has been switched off.

The "load cutout" line also leads to the closed-circuit current cutout relay K72. This relay switches the load circuits for:

- Seat adjustment, rear head restraint adjustment, steering column adjustment and roller sunshade.

The relay K72 therefore disconnects these systems from the terminal 30 supply 16 minutes after terminal R is switched off.

The specified loads are switched on again when terminal R or terminal 15 is switched on or when a signal change takes place at an input of the general or peripheral module: e.g. opening a door, opening the front lid, unlocking a door.

### Note

In the case of faults in the voltage supply for seat and steering column adjustment, in addition to checking the supply lines and fuses, the closed-circuit cutout relay must also be checked with the diagnosis program "closed-circuit current cutout".

## Actuator motors with "ripple-counter" system

### General

On the E38 seat/steering column memory (SM/LSM), the actuator motors for seat and steering column are no longer switched on and off by means of power transistors or relays installed in the control unit. Activation takes place by means of a control module (ripple-count module or RC module) mounted on the motor.

Each actuator motor is equipped with an RC module. The motor and module form one component.

This module contains the electronic circuitry to drive the motors as well as the electronic circuitry to record the motor speed and motor position. Each RC module can, therefore switch on "its" motor independently and move to a specified position.

### Link between control unit SM/LSM and RC module

The relevant RC module is connected to the control unit SM/LSM by means of a simple data link. Following information is transferred via this data link:

- From control unit SM/LSM to RC module: Required direction and required speed.
- From RC module to control unit SM/LSM: Position reached; information whether motor stationary or running; information concerning the status of the output stage (short-circuit yes or no).

### Activation of actuator motors with RC module

Following functions serve the purpose of activating the actuator motors:

- Switching on and off the actuator motors with power transistors contained in the RC module. Relays rendered unnecessary.
- Speed control of actuator motors by driving the relevant actuator motor with pulse width-modified pulses (pulse width modulation).
- Short-circuit and overload protection integrated in RC module.
- Limiting the start-up current by uniform "start-up" of the switch-on pulse width.
- Automatic cutout of motor when drive operation completed.

### Acquisition of motor position with RC module

The position of the motor shaft is achieved by counting the "current ripple" (current changes or magnetic field fluctuations of a DC motor) or by counting pulses produced by a pulse generator. Feedback potentiometer required up until now are no longer needed.

## Operation of the seat/steering column memory

## Manual adjustment of drives

The adjustment switches in the switch block are used for manual adjustment of the seat. The adjustment switch (with integrated control unit) is located on the side of the seat on the side facing the driver's door.

Following drives can be operated by means of the switches:

- Seat longitudinal drive
- Seat height drive
- Seat inclination drive
- Back-rest drive
- Head restraint drive

Separate switches are provided for the drives longitudinal seat adjustment (thigh support) and back-rest adjustment.

Manual adjustment of the steering column is possible with the steering column adjustment switch.

To improve the adjustability of the seat and steering column, the displacement speed of each drive can be varied. When the adjustment switch is depressed, the relevant drive runs at low speed. If the adjustment switch is pressed longer, the voltage slowly increases to the final value. The displacement speed is controlled by controlling the clock pulse cycles of the motor voltage.

## Programming a memory position

- The ignition lock in the vehicle must be set to position 1 or 2.
- Press the memory button on the memory switch. The memory button lighting up indicates that the system is ready to be programmed.
- The current position of the seat, mirror and steering column is adopted by pressing one of the 3 position buttons.
- The indicator lamp goes out after pressing the position button.
- The program standby mode is cancelled if no position button is pressed within 7 s. The light in the position button goes out.

## Calling up a memory position

Basically, a differentiation is made between 2 modes of operation when calling up stored positions:

- Strike button mode:  
In strike button mode, briefly pressing one of the 3 position buttons is sufficient to start the positioning procedure. Positioning is continued automatically until the destination position is reached. Strike button mode is effective when the ignition lock is set to position 1, or when the driver's door is opened (in ignition lock position 0 or 1).
- Permanent button mode:  
Permanent button mode is effective as of ignition lock position 2. To call up a seat position, the corresponding position button must be permanently pressed in order to maintain the positioning procedure. If the button is released before the destination position is reached, the corresponding drive is switched off immediately. The positioning procedure is continued when the position button is pressed once again. If one of the other position buttons is pressed, positioning to the new destination position is started.

## Detecting end stops

In order to avoid unnecessary overloading of the drives and of the RC module, an automatic detection facility is provided for the adjustment range limits.

If blocking occurs several times at the same point, the recorded position value is evaluated as the end limit stop. All further adjustment operations are interrupted before this limit is reached.

An incorrectly detected end limit stop (e.g. caused by obstacle blocking the seat), can be overcome after removing the obstacle by renewed operation of the manual adjustment switch.

## Entry/exit aid in steering column memory

The steering column memory features an entry/exit aid. It raises the steering column to facilitate entry and exit.

The control for the entry/exit aid is derived from several vehicle signals.

The steering column assumes the higher inclination position in following cases:

- The ignition lock is switched in position 0.
- The ignition lock is in position 1 and the driver's door is opened.
- In ignition lock position 2, the driver's door is opened with the handbrake applied.

The return position is assumed in following cases:

- The ignition lock is switched to position 2.
- The handbrake is released or the driver's door is closed.

Automatic steering column adjustment is terminated simply by pressing the steering column adjustment switch (in any direction). The steering column stops immediately and does not continue positioning. The motors can only be driven when the switch is operated once again.